REMARKS

In the last Office Action, claims 1, 2, 4-6, 9-12, 14-20 and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,191,410 to Johnson ("Johnson") in view of U.S. Patent No. 5,446,290 to Fujieda et al. ("Fujieda"). Claims 3, 7, 8 and 21-25 were rejected under 35 U.S.C. §103(a) as being unpatentable over Johnson and Fujieda and further in view of U.S. Patent No. 5,869,791 to Young ("Young").

Claim 18 was objected to as being a duplicate of claim 15.

In accordance with this response, claims 1, 6, 11, 14, 15, 16 and 18 have been amended to more particularly and more clearly point out the novel features of the invention, and new claims 27-30 have been added to provide a fuller scope of coverage. Claim 18 has been amended to recite that the opposed front and rear surfaces of the light guiding plate are parallel to one another thereby distinguishing claim 18 from claim 15 and thus obviating the objection of claim 18 as being a duplicate of claim 15.

The present invention pertains to a fingerprint reading device and method which use an inexpensive, thin liquid crystal display for accurately reading fingerprints. As shown, for example, in the embodiment of Figs. 1A-1B, the

inventive fingerprint device 10 comprises a liquid crystal cell 11, and an illumination source 14 for projecting light from the rear surface to the front surface of the liquid crystal cell 11. A light guiding plate 12 is disposed on the front surface of the liquid crystal cell 11 for transmitting light projected by the illumination source 14 through the liquid crystal cell 11 to a person's finger in contact with a front surface of the light guiding plate 12 and reflecting light reflected from the finger on a rear surface of the light guiding plate toward a side end surface of the light guiding plate. This is shown in the explanatory view of Fig. 2B which shows the light path of light passing through one pixel of the liquid crystal cell 11 through the light guiding plate 12 to a finger 60, which reflects the light back through the light guiding plate 12 to the rear surface thereof which reflects the light toward the side end surface of the light guiding plate 12.

A light receiving device 13 is positioned to receive reflected light exiting from the side end surface of the light guiding plate 12. A drive circuit (shown in Fig. 2A) drives the liquid crystal cell 11 to pinpoint-irradiate a fingerprint of the finger by pinpointing with the light emitted from the illumination source 14 to cause the light receiving device 13 to pinpoint-receive the light reflected by the fingerprint to thereby obtain an image of the fingerprint.

In accordance with the invention, the light guiding plate 12 transmits therethrough the light projected by the illumination source 14 so that the light is reflected from the finger, and the reflected light from the finger is transmitted into the light guiding plate 12 and reflected from the rear surface thereof toward the side end surface of the light guiding plate.

The inventive fingerprint reading device 10 can detect a fingerprint comparatively easily by use of a liquid crystal cell 11 and a light guiding plate 12. Further, the fingerprint reading device 10 has a structure similar to that of a crystal liquid display device and can be relatively simply manufactured at a low cost. The fingerprint reading device 10 can also be easily incorporated together with a liquid crystal panel into an electronic apparatus, such as a cellular phone. The liquid crystal cell 11 is preferably an active matrix crystal cell that can be easily driven in a known manner to enable accurate reading of fingerprints.

Amended independent claims 1 and 11 each require a light guiding plate for transmitting light projected through the liquid crystal cell to a person's finger in contact with the front surface of the light guiding plate and for reflecting light which has been reflected from the finger onto a rear surface of the light guiding plate toward a side

end surface of the light guiding plate. Amended method claim 6 includes the step of providing a light guiding plate on a front surface of the active matrix crystal cell opposite the rear surface for receiving light coming from the rear surface and reflecting on a rear surface of the light guiding plate toward a side end surface thereof light that enters the light guiding plate from a front surface thereof and that is directed toward the rear surface. Newly added method claim 27 includes the step of using a light guiding plate to guide light reflected by the finger in a direction generally transverse to the direction in which the light is directed through the light guiding plate to illuminate the finger by reflecting the reflected light from a rear surface of the light guiding plate toward a side end surface thereof. The prior art of record fails to disclose or suggest the use of a light guiding plate in the manner recited in these claims.

Johnson discloses a fingerprint reading device and method having a light guiding member disposed on a liquid crystal cell. In the Fig. 3 embodiment of Johnson, which has been relied upon by the Examiner, the light guiding member 1 is a wedged-shape prism which requires either use of a lens wafer 23 or a surface-emitting laser (see paragraph bridging columns 1-2). Due to the wedge-shaped prism 1, the distance between the front surface of the liquid crystal display and

the light source is not constant and therefore in order to maintain the proper spotlight size at the fingerprint surface, either the lens wafer 23 or a surface-emitting laser must be used. Therefore the Johnson fingerprint reading device cannot be made thin and is relatively expensive to manufacture. These drawbacks are obviated by the light guiding plate of the present invention, which ensures that light travels uniformly through the flat light guiding plate so that the resolution of a fingerprint read by the device is not dependent upon which portion of the fingerprint is being read.

According to the rejection, the Examiner contends that it would have been obvious to one skilled in the art to modify the wedge-shaped light guiding plate 1 of Johnson to include one with parallel opposed main faces as taught by Fujieda since Fujieda teaches that a light guiding plate with parallel opposed main faces is advantageous for controlling the amount of light and color. Applicants respectfully point out, however, that the Examiner has apparently overlooked the fact that the flat light guiding plate 13 of Fujieda transmits reflected light from the finger downwardly through the plate 13 to photo-sensitive elements 24 on the rear surface thereof -- not transversely or sideways to a side end surface of the plate 13 as required by the claims. Thus if the Johnson device of Fig. 3 were modified as proposed by the

Examiner to replace the wedged-shape prism 1 with a flat light guiding plate 13 as taught by Fujieda, the Johnson device would have also be modified to omit the photoelectric sensor 3 at the side end surface of the prism 1 since the light guiding plate 13 of Fujieda directs the reflected light from the finger downwardly through the plate 13 -- not transversely toward a side end surface thereof. Such a modified device, however, would not at all resemble that recited in the claims.

The optical element 13 of Fujieda is constructed so that light may be focused on the finger contact area along the center lines between openings 28 and photo-sensitive elements 24 of the LCD matrix 12. In one embodiment of the optical element 13 shown in Fig. 7 of Fujieda, it can readily be seen that light emitted from the planar light source 11 passes vertically through a transparent substrate 21 and the optical element 13, and is applied obliquely onto a finger placed in contact with the optical element 13. Light reflected from an interface between the finger and the optical element 13 reaches the photo-sensitive element 24 by passing vertically through routes different from the optical paths of the incident light, as seen from Fig. 7. The light shielding plates 23 prevent the light from the planar light source 11 from being directly applied to the photosensitive elements 24.

The use of vertically-oriented light paths such as fiber optic elements in the optical element 13 of Fujieda maintains vertical light paths which differ for light projected toward the finger and light reflected by the finger. Thus, all light that passes through the optical element 13 of Fujieda must do so in only a vertical direction. The vertical arrangement of the light guides <u>prevents</u> reflection of light from the rear surface toward a side end surface of the optical element 13, as required by independent claims 1, 6, 11 and 27.

For the reasons stated above, it is clear that Fujieda does not suggest modifying Johnson to provide a flat light guiding plate that reflects light from a rear surface of the plate toward a side end surface thereof. As described above, the optical element 13 of Fujieda is not capable of achieving this function. Thus, Fujieda provides no suggestion to modify the Johnson device to provide the claimed light guiding plate

Young does not cure the foregoing defects. Young discloses a touch sensitive input device comprised of a plurality of individually operable touch-sensitive elements having first and second overlapping and spaced conductive layers 12, 15 with the second conductive layer being displaceable towards the first conductive layer in response to a touch input. Young does not suggest modifying Johnson to

provide a flat light guiding plate having parallel opposed main faces.

For the foregoing reasons, applicants respectfully submit that independent claims 1, 6, 11 and 27 patentably distinguish over Johnson taken in combination with Fujieda and Young. For the same reasons, dependent claims 2-5, 7-10, 12, 14-26 and 28-30 are allowable over the prior art of record. Thus, applicants respectfully submit that the claim rejections under 35 U.S.C. §103(a) should be withdrawn.

Respectfully submitted,

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